Timebase Calibration for DDS RF Signal Generator

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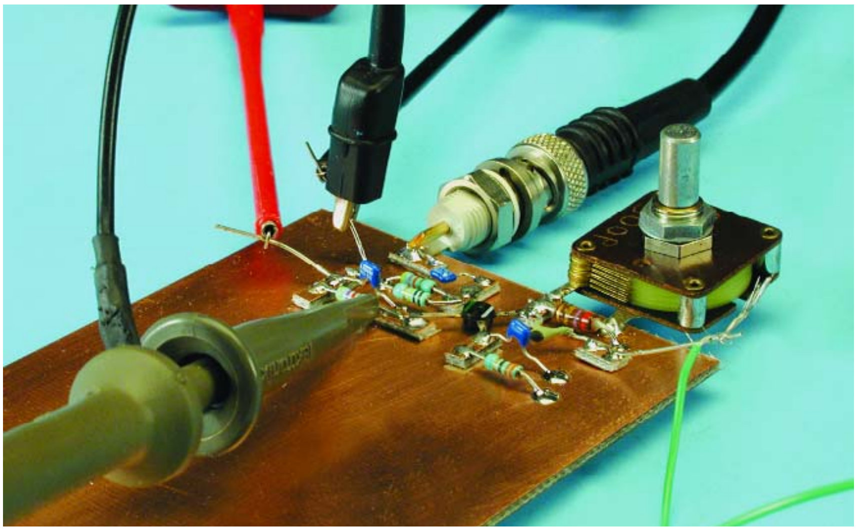
The DDS RF Signal generator described in the October 2003 issue of *Elektor Electronics* has an internal 10 MHz quartz crystal oscillator for the AD9851 DDS chip. Obviously, the output frequencies supplied by the generator are only correct if the quartz crystal is adjusted to exactly 10.000 MHz using trimmer C22. For many applications like repair work on 445 kHz or 10.7 MHz IF amplifiers, the frequency of the signal supplied by the instrument is not terribly important. However, 'netting' narrow band FM (NBFM) equipment like a 6-m (50 MHz) amateur radio transceiver does require a frequency-accurate test source. After all, if you adjust the transceiver with the aid of a signal generator, any error in the frequency supplied by the latter is copied by the local oscillator(s) of the 50-MHz receiver.

Off-air — free and extremely stable

If you think that an £10k very high-end and hyper-accurate frequency source is required to calibrate your RF DDS Signal Generator, you will be pleasantly surprised to know that such sources are (1) free, (2) available in your home and (3) accurate to a level that should exceed most, if not all, amateur requirements. We're talking about MW broadcast transmitters (between 600 kHz and 1,500 kHz) in your region. Signals received from such a transmitter can be used without too much of a problem to calibrate the timebase oscillator in your signal generator. All you need is an add-on mixer that will produce 'zero beat' when the two frequencies are equal. This will be indicated by an oscilloscope.



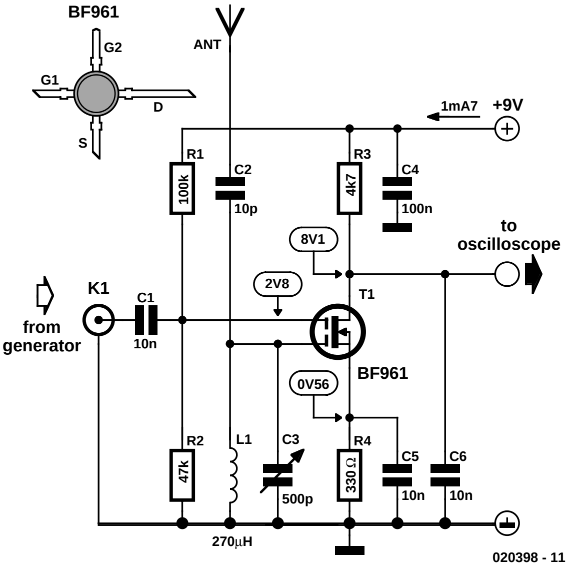


Figure 1. This beat detector employs an oscilloscope and an MW broadcast signal to calibrate the 10-MHz timebase oscillator in the DDS.

Practical circuit

The RF mixer shown in **Figure 1** is a dead conventional design around a dual-gate MOSFET. The AM broadcast signal arrives at gate 1. A strong AM broadcast station can be selected between 600 kHz and about 1,500 kHz using an L-C tuned circuit consisting of a choke and a 500-pF mica tuning capacitor. The antenna consists of a few metres of wire. The RF DDS Signal generator is tuned to the official AM station frequency and its output signal injected into gate 2 via a 10nF coupling capacitor. The mixer output signal can be taken from the drain of T1 and fed to an oscilloscope. The lower the frequency variation of the signal shown by the 'scope, the closer you are to

10.000 MHz with your calibration of the generator timebase.

Practical use

Start by finding the strongest MW broadcast transmitter in your region. If necessary, use a frequency list to find a suitable station. Remember, the add-on mixer is not designed for selectivity or sensitivity so you need to find a really strong signal.

Set the oscilloscope to 2-ms timebase, AC-coupled and high sensitivity. Watch the trace on the ‘scope , tune C1 for resonance and listen to a MW radio to make sure you’re correctly tuned. Keep the antenna away from noise sources like fluorescent tubes and PCs.

On the signal generator, set an output level of 0 dBm and enter the **exact** frequency of the station as taken from the list.

Watch the ‘scope display as you carefully adjust C22 in the generator. At some point you will see the frequency difference (‘beat’ note) between the two sources in the form of slow amplitude variation(s). The optimum setting for C22 is obtained when the two signals approach ‘zero beat’ as close as possible. A calibration accuracy of less than 1 Hz should be within easy reach.

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